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TITLE: WORK OF BREATHING AS A PREDICTOR OF FAILURE TO WEAN FROM MECHANICAL VENTILATION IN PATIENTS WITH SEVERE CHRONIC OBSTRUCTIVE PULMONARY DISEASE

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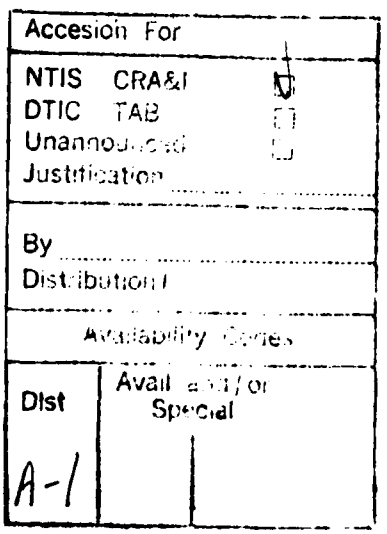

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INTRODUCTION

For the vast majority of patients who require mechanical ventilation, withdrawal of ventilatory support and extubation is straightforward and easily accomplished. However, those patients who have required prolonged ventilatory support and especially those with severe baseline pulmonary disease can present a particular problem. It is not always clinically evident when the patient is ready to be removed from ventilatory support. Extubation before the patient is prepared to support his own ventilatory demands can result in respiratory failure, and the requirement for reintubation and placement back on the ventilator. Reintubation, especially under urgent circumstances, is not without risks, such as aspiration and hemodynamic instability. The fatigue and stress that the patient develops while experiencing respiratory failure can also set back his clinical course significantly. Whereas a few more days of exercise prior to the initial extubation might have ensured success, the patient might now require days to weeks to again be ready for extubation. Conversely, the conservative approach might prolong the weaning process longer than is required, delay extubation and increase the chance for nosocomial complications, such as pneumonia.

Because of these limitations, physiologic parameters were developed to assist in determining the adequacy of the patient's cardiorespiratory status. These parameters can easily be performed at the bedside and have well defined ranges. While these parameters are useful in short term ventilator patients, in the long term ventilatory support patient population they have a well documented poor specificity. Patients can meet these criteria and still fail weaning. Thus the question arises as to whether there are other indices that could be used to predict the patient's readiness to support spontaneous ventilation. Can the amount of work the patient must perform to breathe be measured and used to predict how the patient will do once removed from the ventilator? If so, this could be invaluable in shortening the time a patient is on mechanical ventilation, in the ICU, and may potentially decrease mortality.

The utility of measuring the patient's work of breathing has been examined with promising results. It has been shown that long term ventilator patients can have abnormally high work of breathing requirements even with adequate bedside parameters[1,3]. As the patient improves and begins weaning the work of breathing returns toward normal[1]. Other studies have tried to use work of breathing measurements to predict which patients are ready to begin weaning[2,4]. While these studies did suggest that certain cutoffs could be demonstrated to predict readiness to wean, they were all done on general patient populations, and did not identify patients with significant baseline pulmonary disease.

While the values obtained in these patients might extrapolate to other patients without significant pulmonary disease, the values may not be applicable to patients with severe disease. At the same time, these patients can have a much higher work of breathing than the normal population. One study suggested that the baseline work of breathing in these patients can be greater than 10% of their total oxygen consumption, in contrast to less than 5% in patients without pulmonary disease5. Thus the cutoff values for work of breathing generated in the previous studies might be invalid for patients with severe COPD. This study will be the first to look exclusively at this patient population and try to identify whether using the patient's work of breathing can be used to predict the ability of the patient to sustain spontaneous respiration.

BODY

The study will be prospective. Patients with severe chronic obstructive pulmonary disease (COPD) requiring mechanical ventilation for more than 24 hours will be studied. Once the primary team has decided that the patient is ready for extubation, he is entered in the study. Just prior to extubation the patient will have his work of breathing measured by the metabolic cart. He is then extubated as planned. No evaluation prior to study is required and no medications will be used. The patient will then be followed to see if he tolerates extubation or develops respiratory failure, requiring reintubation. Those two groups, patients who tolerate extubation >24 hours and those who require reintubation within 24 hours will be analyzed individually. The mean work of breathing values for the two populations will be be compared to see if there is a significant difference between the two.

CONCLUSION

The census of critically ill patients at Fitzsimons has dropped markedly over the last 2 years. As example, from 1 Jan through 10 August of this year there were 22 total ventilator patients in the MICU. This covers all etiologies of respiratory failure. It became clearly evident that it would be impossible to recruit an adequate number of patients to complete the study. Therefore, while the original questions are felt to still be valid, we were unable to generate data that would allow them to be answered.

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